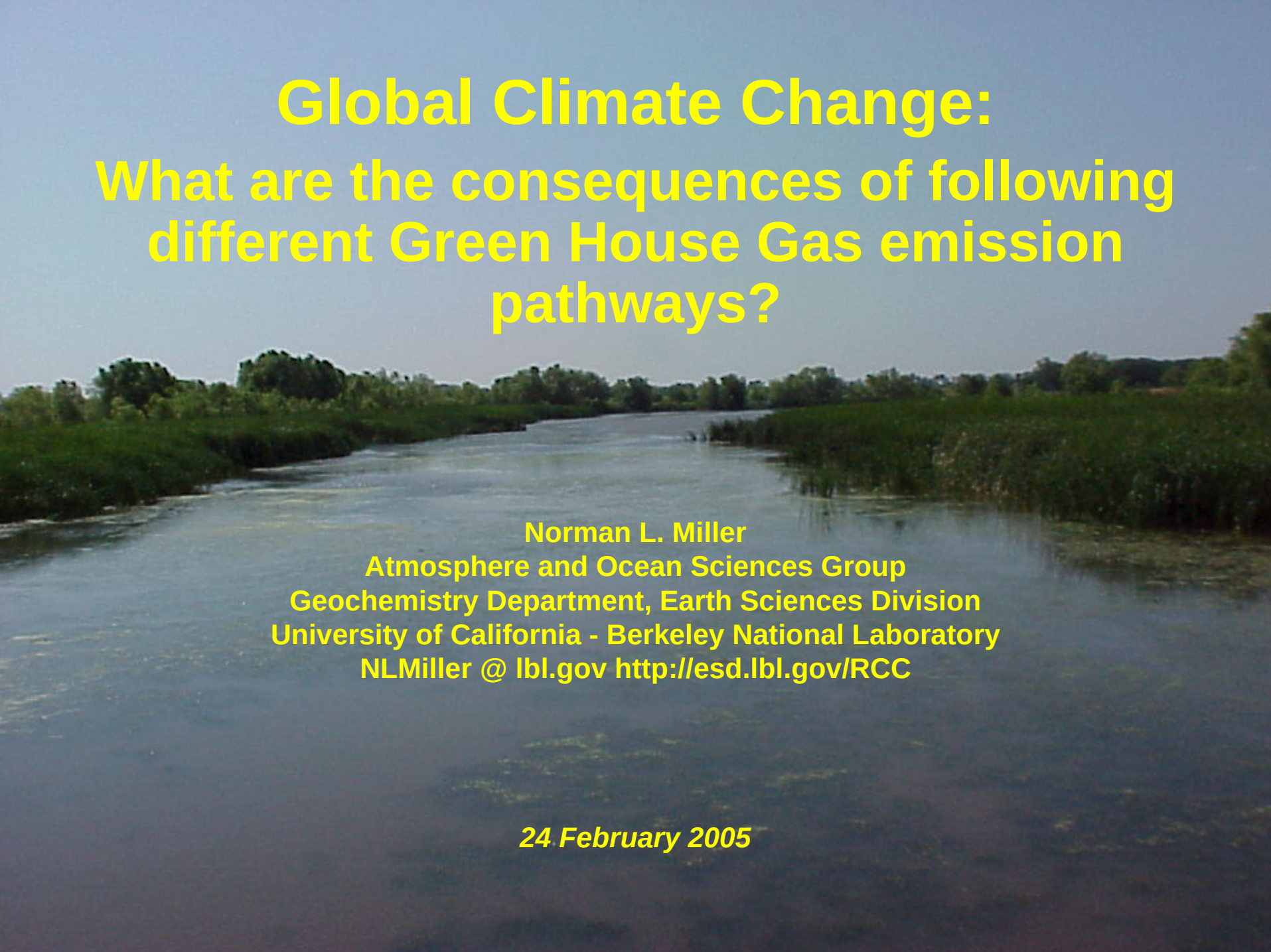

Global Climate Change:

What are the consequences of following different Green House Gas emission pathways?

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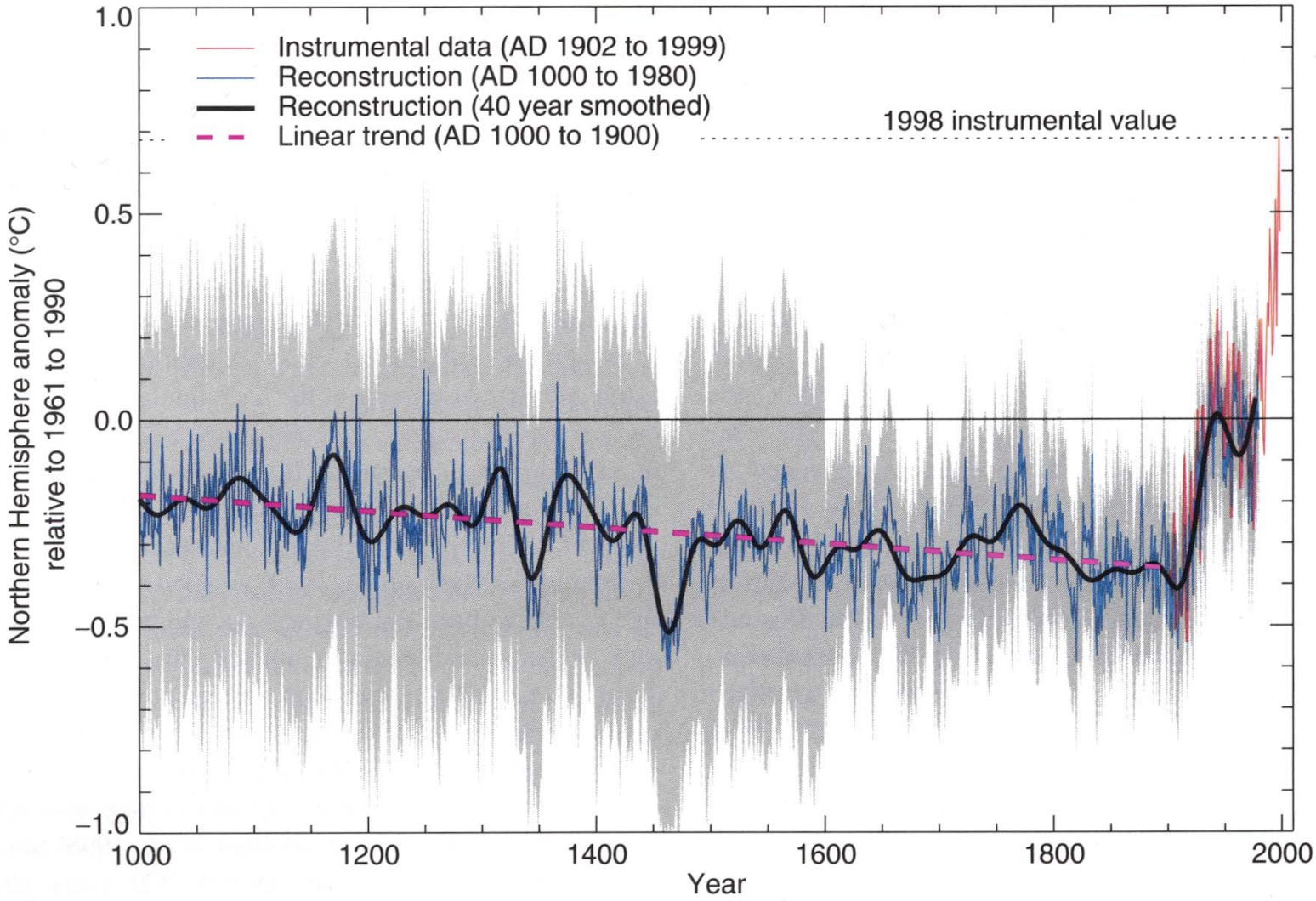
24 February 2005

16 February 2002:
The Kyoto Protocol comes into force

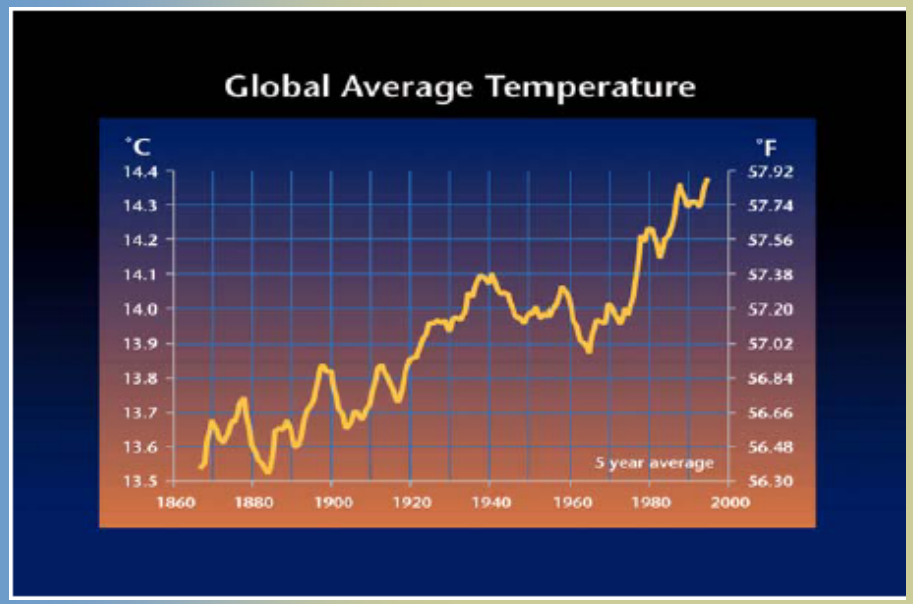
- The Kyoto accord, which aims to curb the air pollution blamed for global warming, has come into force seven years after it was agreed.
- 141 countries, accounting for 55% of greenhouse gas emissions, have ratified the treaty, which pledges to cut emissions from 1990 levels by 5.2% by 2012.
- The world's top polluter - the US - has not signed the treaty because it says the changes would be too costly to introduce and that the agreement is flawed.
- Large developing countries including India, China and Brazil are not required to meet specific targets for now.

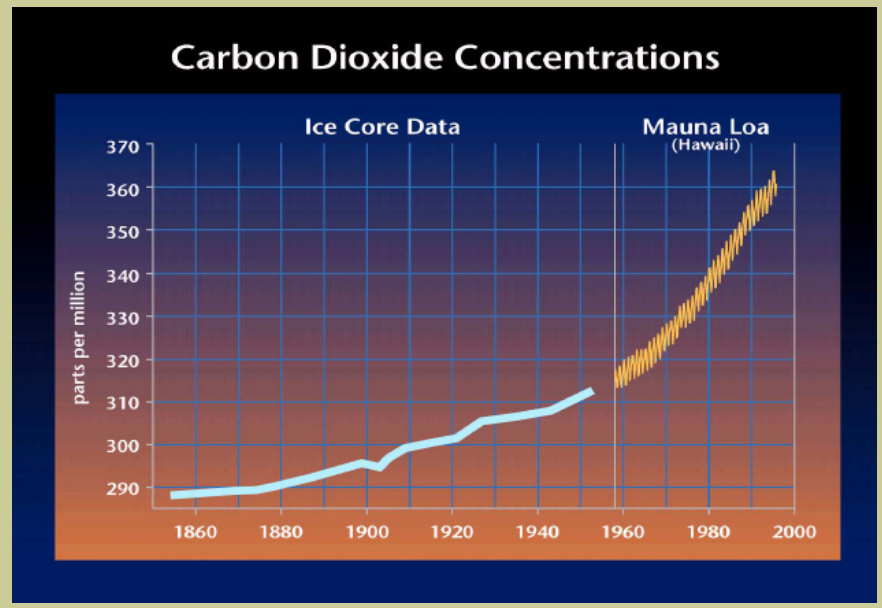
OBSERVED TEMPERATURE HAS INCREASED



Mann et al. 1999, Geophysical Research Letters, 26, 759-762

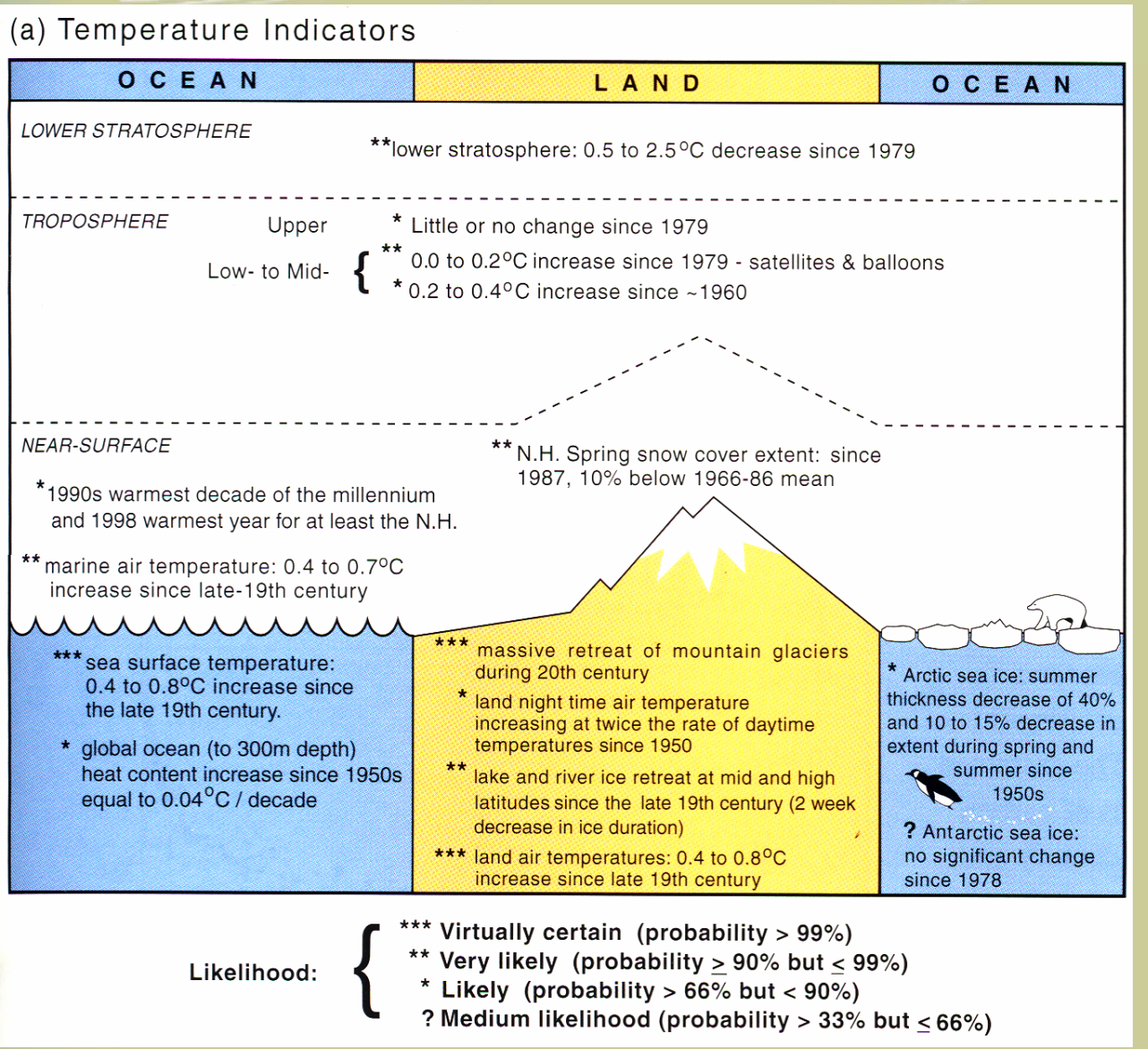
Temperature and CO_2 Increases are Proportional





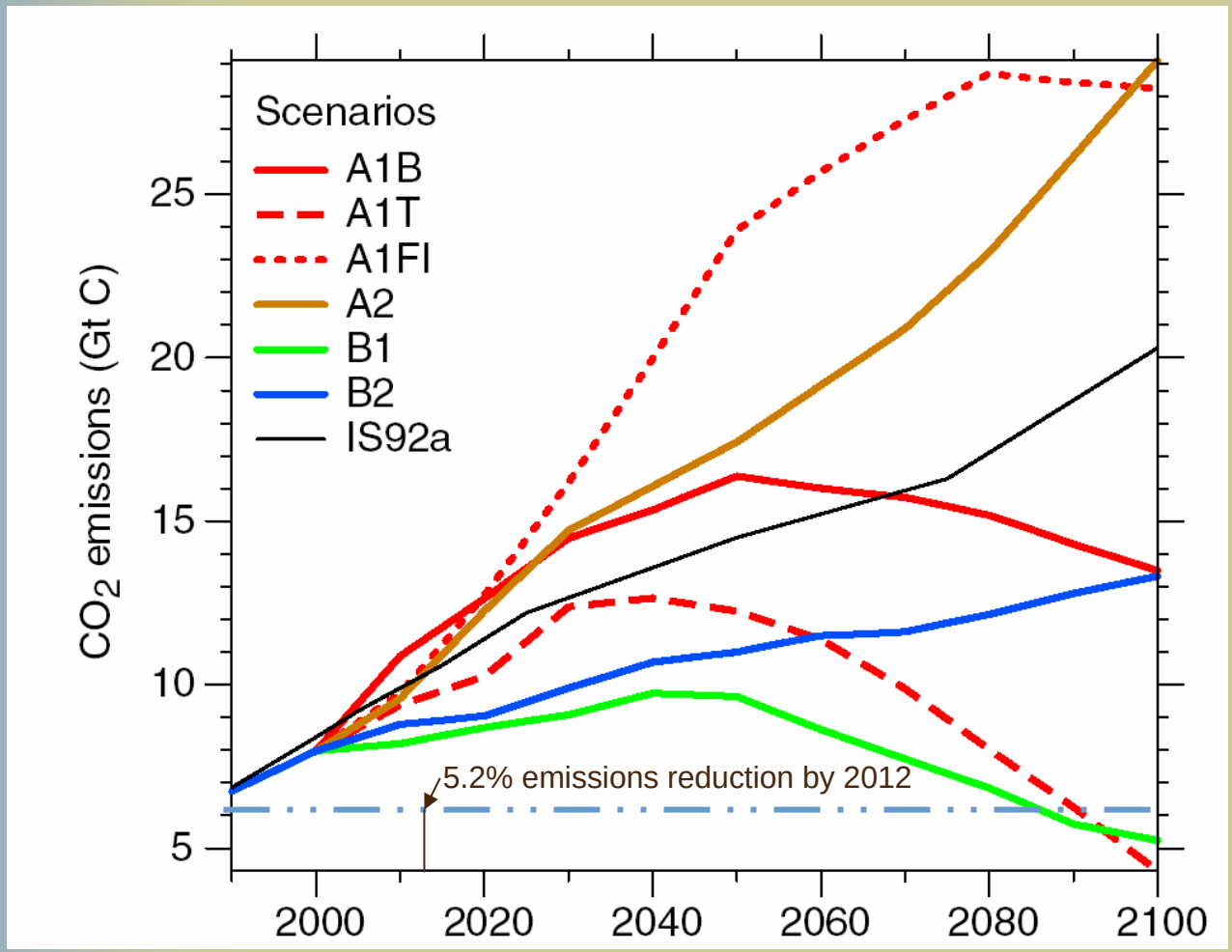
Intergovernmental Panel on Climate Change, 2001

OBSERVED TEMPERATURE INDICATORS



Intergovernmental Panel on Climate Change, 2001

IPCC Special Report on Emissions Scenarios



SRES

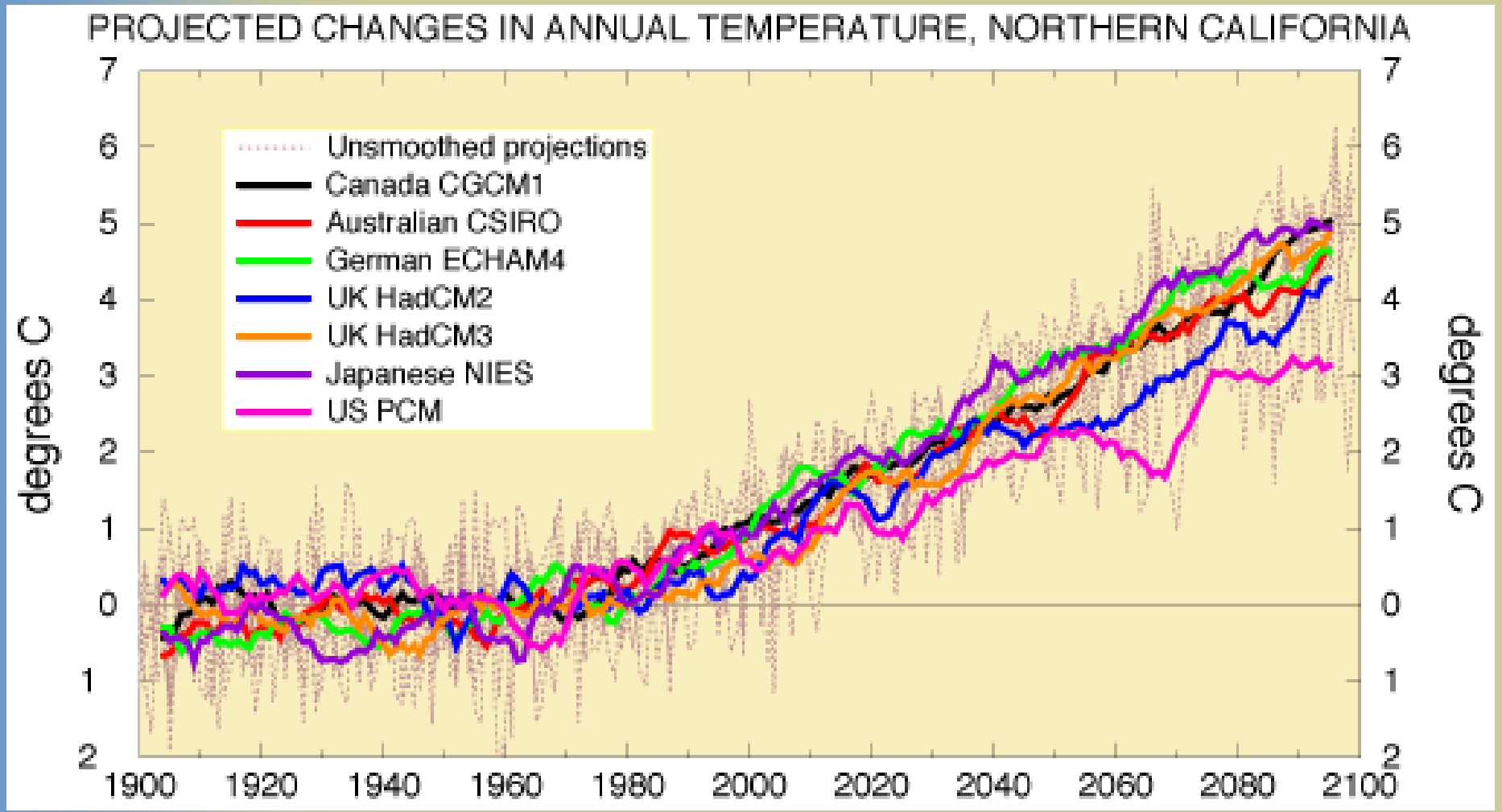
What are the consequences of following different emissions pathways?

- IPCC SRES High and Medium Range Emission scenarios:
  - High emissions: A1fi ("World Market", Fossil Energy Intensive)
    ~970 ppm CO_2 by 2100
  - Med-range Emissions: B1 ("Global Sustainability", Energy Efficiency)
    ~550 ppm CO_2 by 2100

- Global Climate System Models
  - U.S. Parallel Climate Model (PCM) Low Temperature Sensitivity
  - U.K. Hadley Climate Model (HadCM3) Medium Temperature Sensitivity

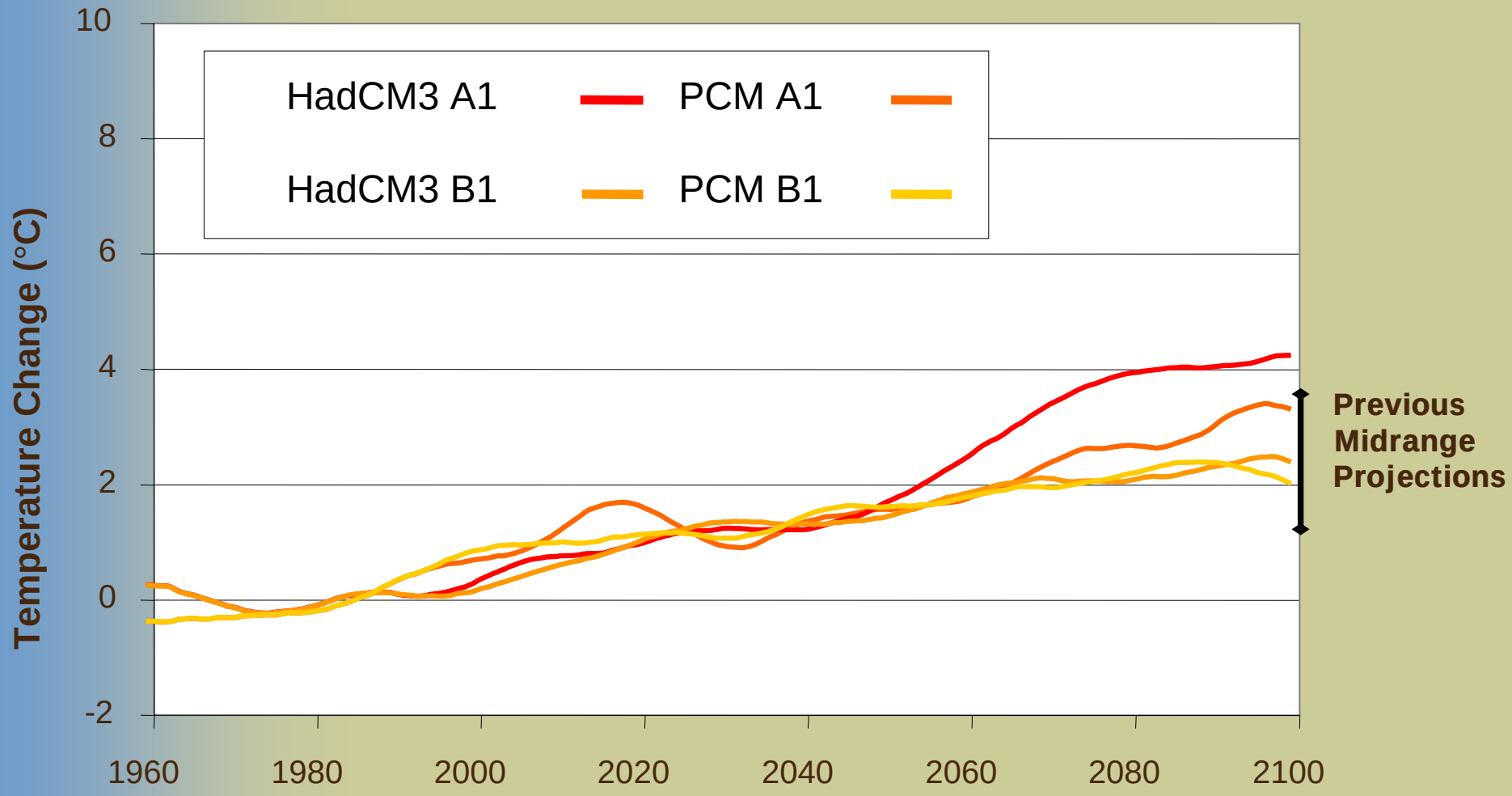
- The four simulations (1900-2100) provide a new outcome envelope
  - Outcomes based on amount of Fossil Fuel use.
  - Reduced uncertainty

Global Climate Model Projections
7 Different GCMs

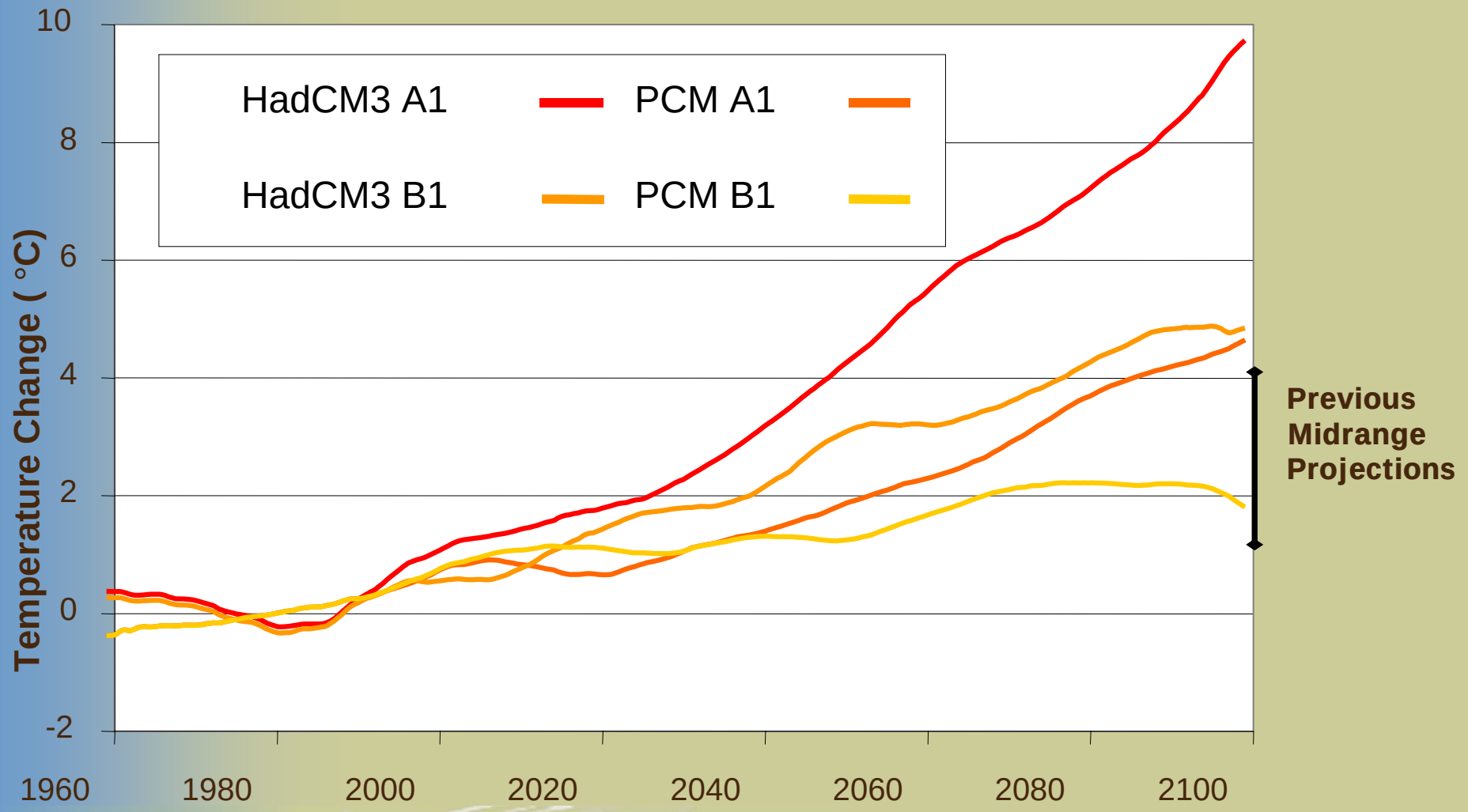


Temperature Sensitivity is the mean temperature difference between 2100 and 2000

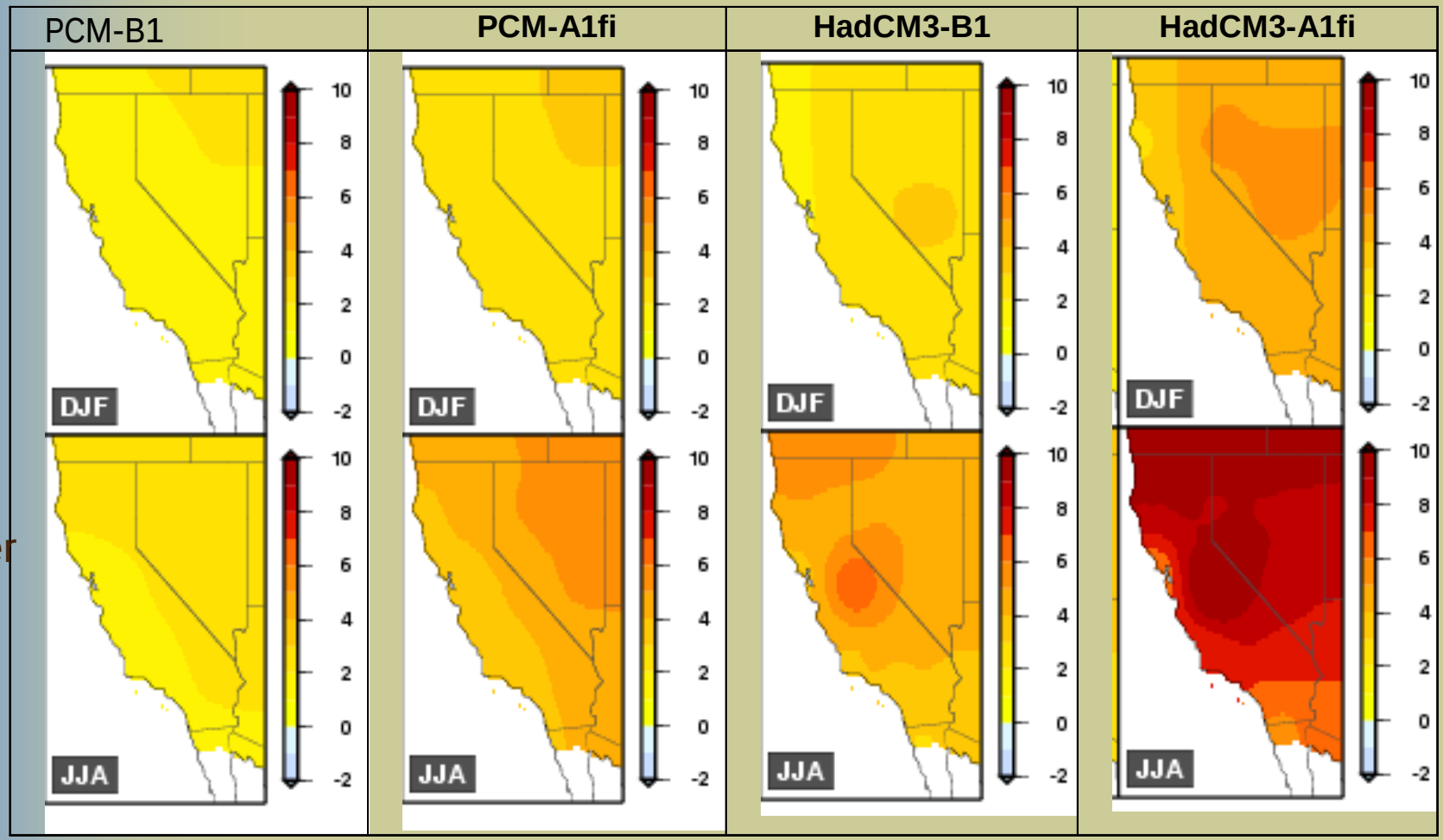
Temperature Projections: Statewide, Winter (DJF)



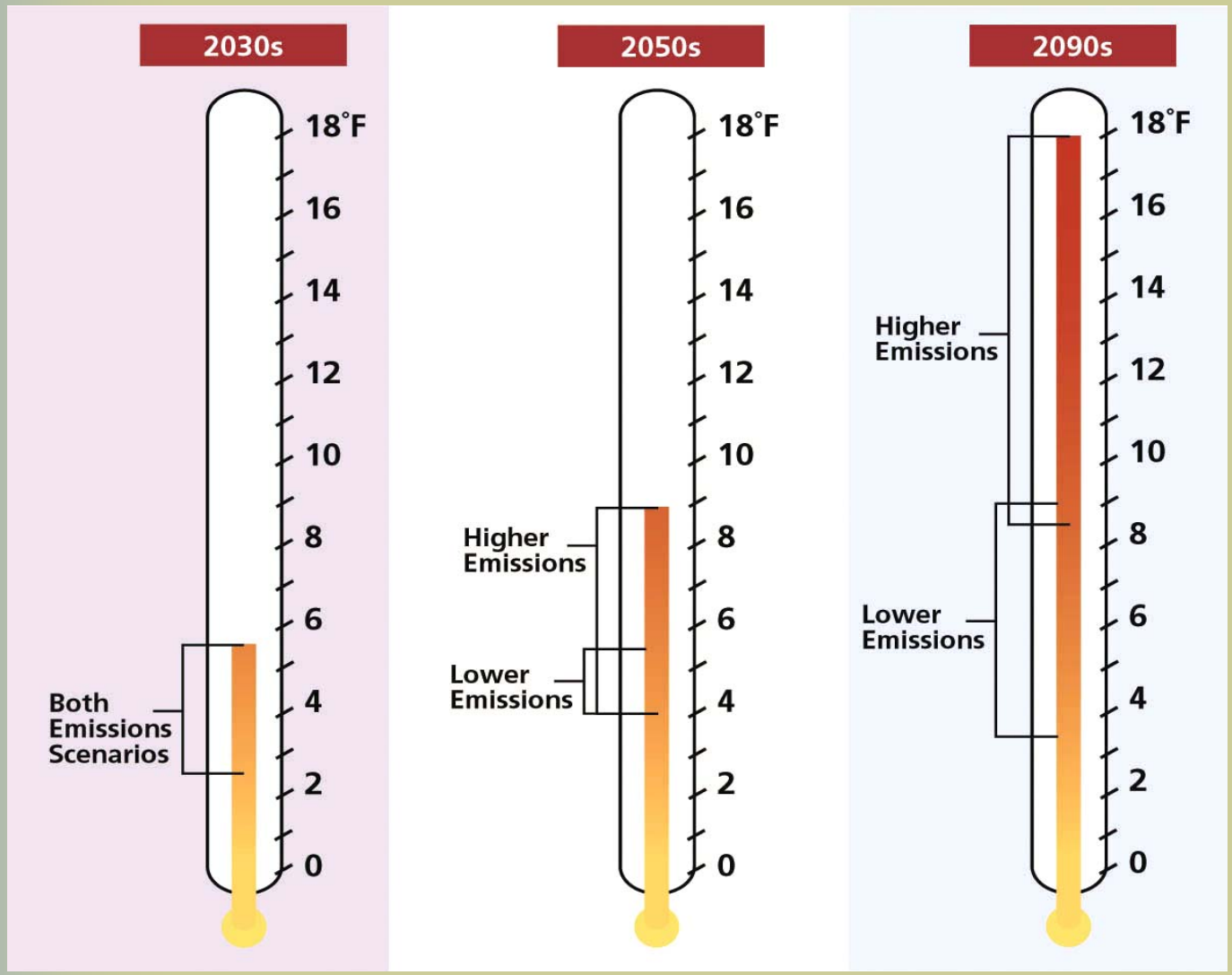
Temperature Projections: Statewide, Summer (JJA)

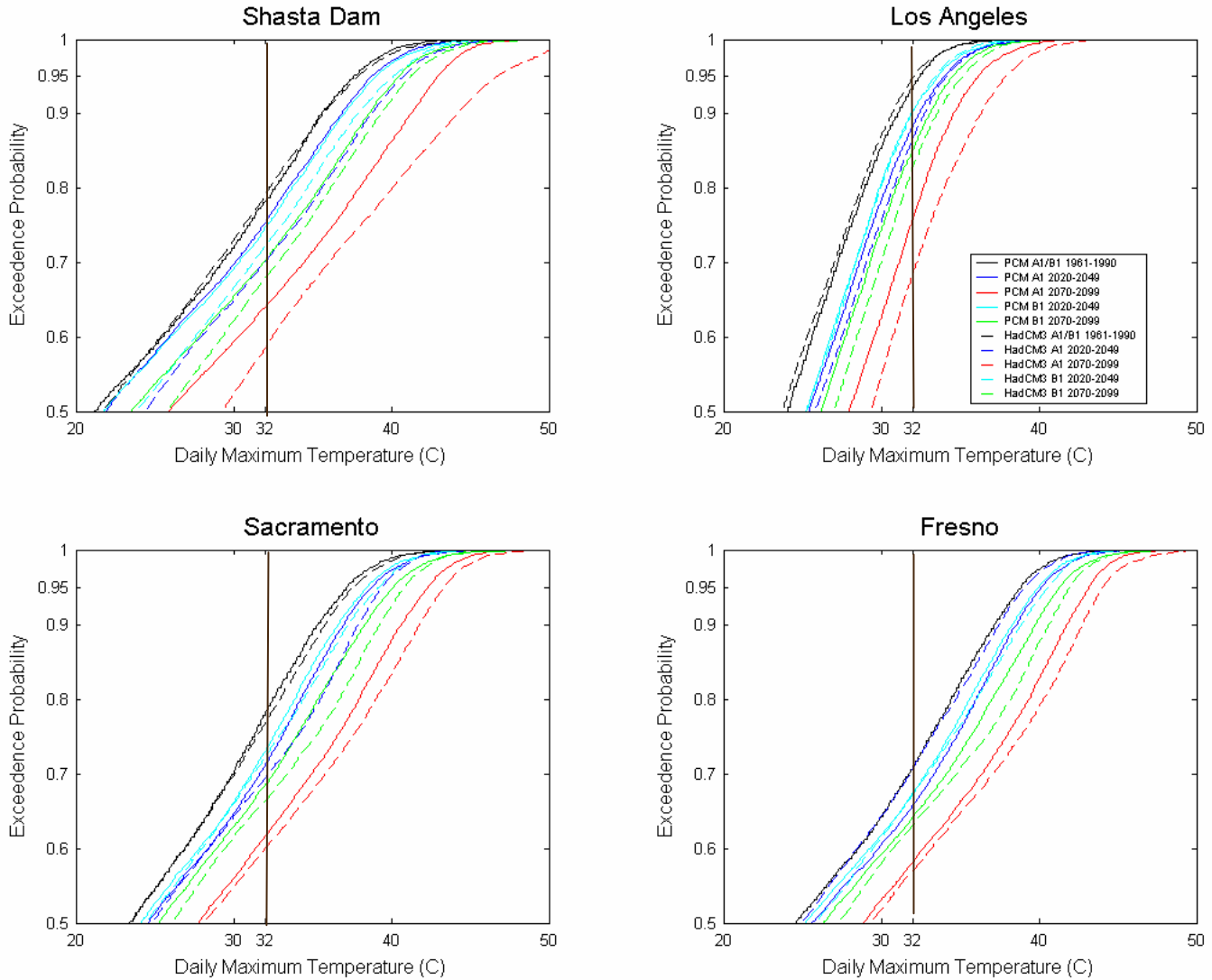


Temperature Change (ºC)
Projected (2099-2070) Minus Historical (1961-1990)



Rising Temperatures
California statewide Average Summer

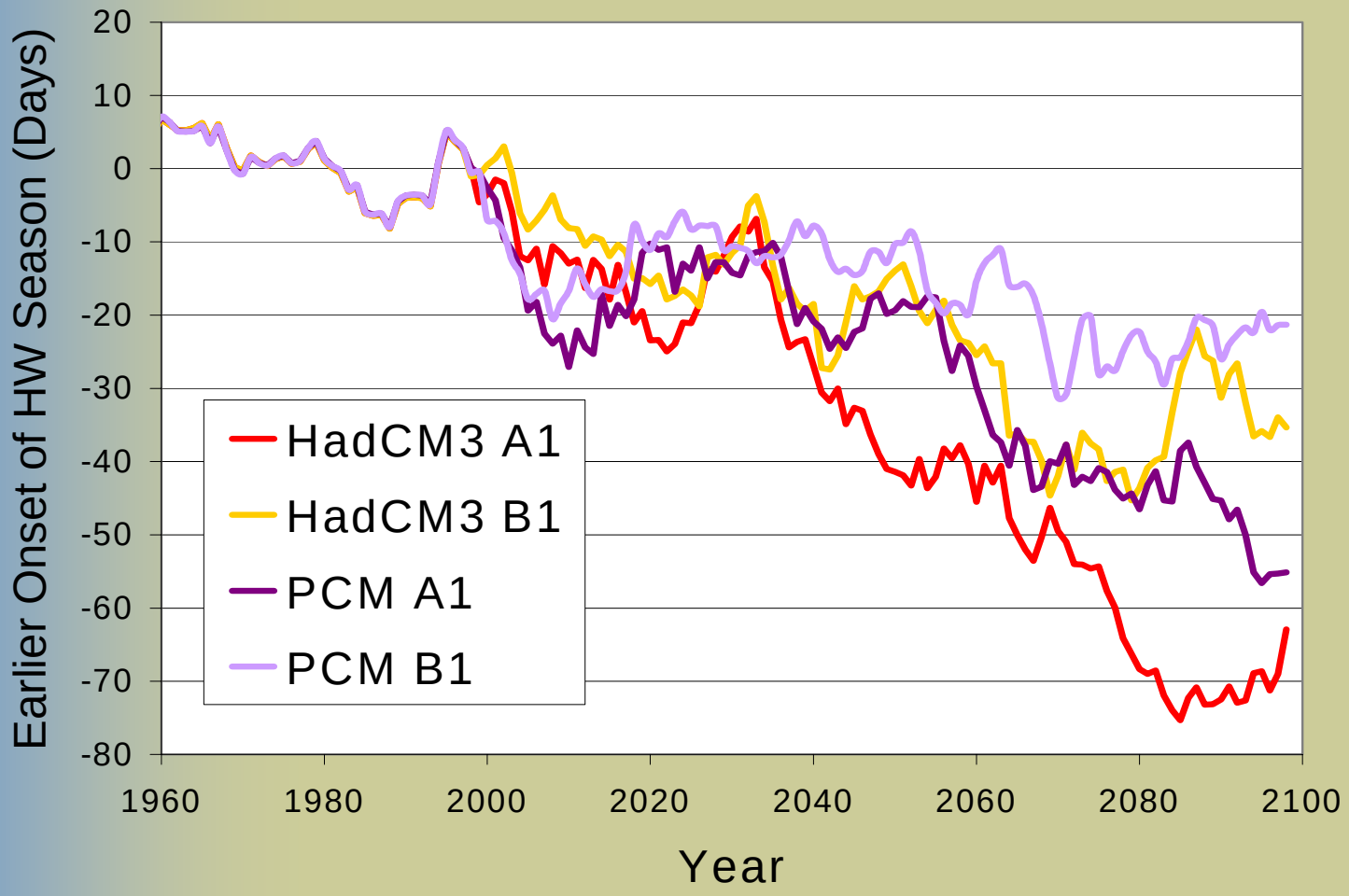




Miller et al. 2004

The 32°C (90°F) Heat Threshold Exceedence shifts 5-30 percent.

California Heat Wave Onset is projected to occur earlier

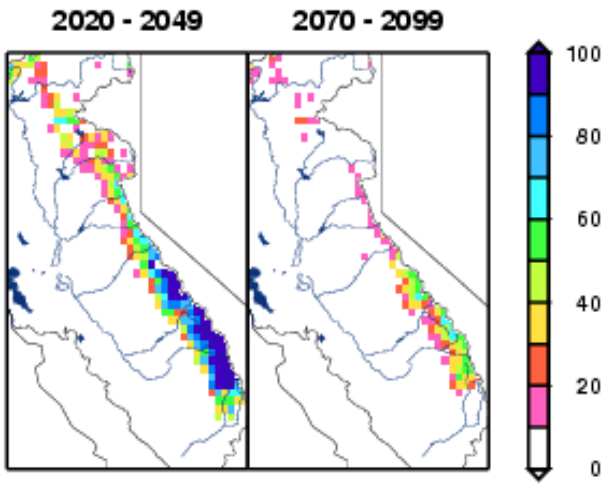
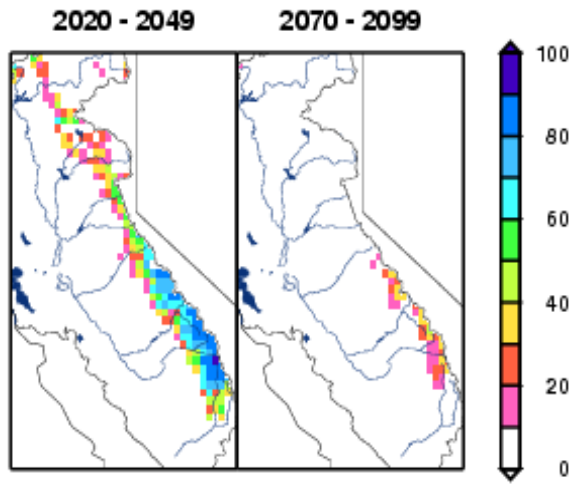
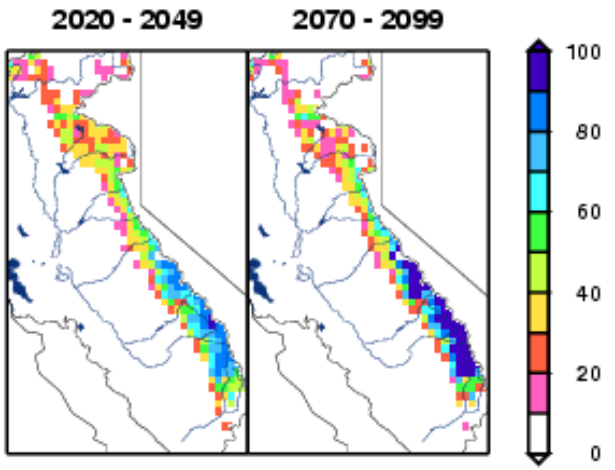
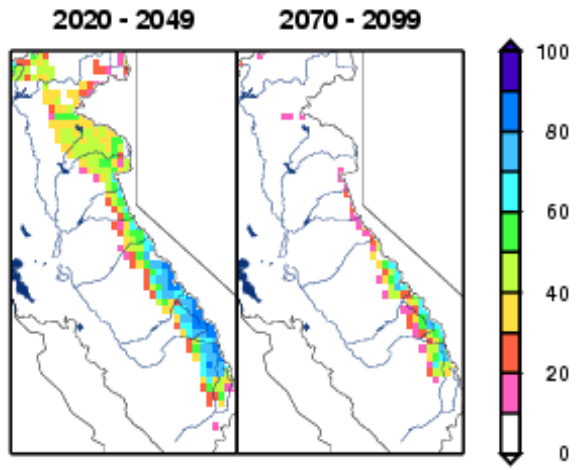


Increase in the number of Heat Waves at ~2100

			PCM		HadCM3		PCM		HadCM3	
			B1	A1fi	B1	A1fi	B1	A1fi	B1	A1fi
		1961-1990								
Heatwave days										
Los Angeles	days	12	28	35	24	36	44	76	47	95
Sacramento	days	58	91	101	93	104	109	134	115	138
Fresno	days	92	113	120	111	116	126	147	126	149
El Centro	days	162	185	185	176	180	191	213	197	218

Percent Sierra Snowpack Remaining

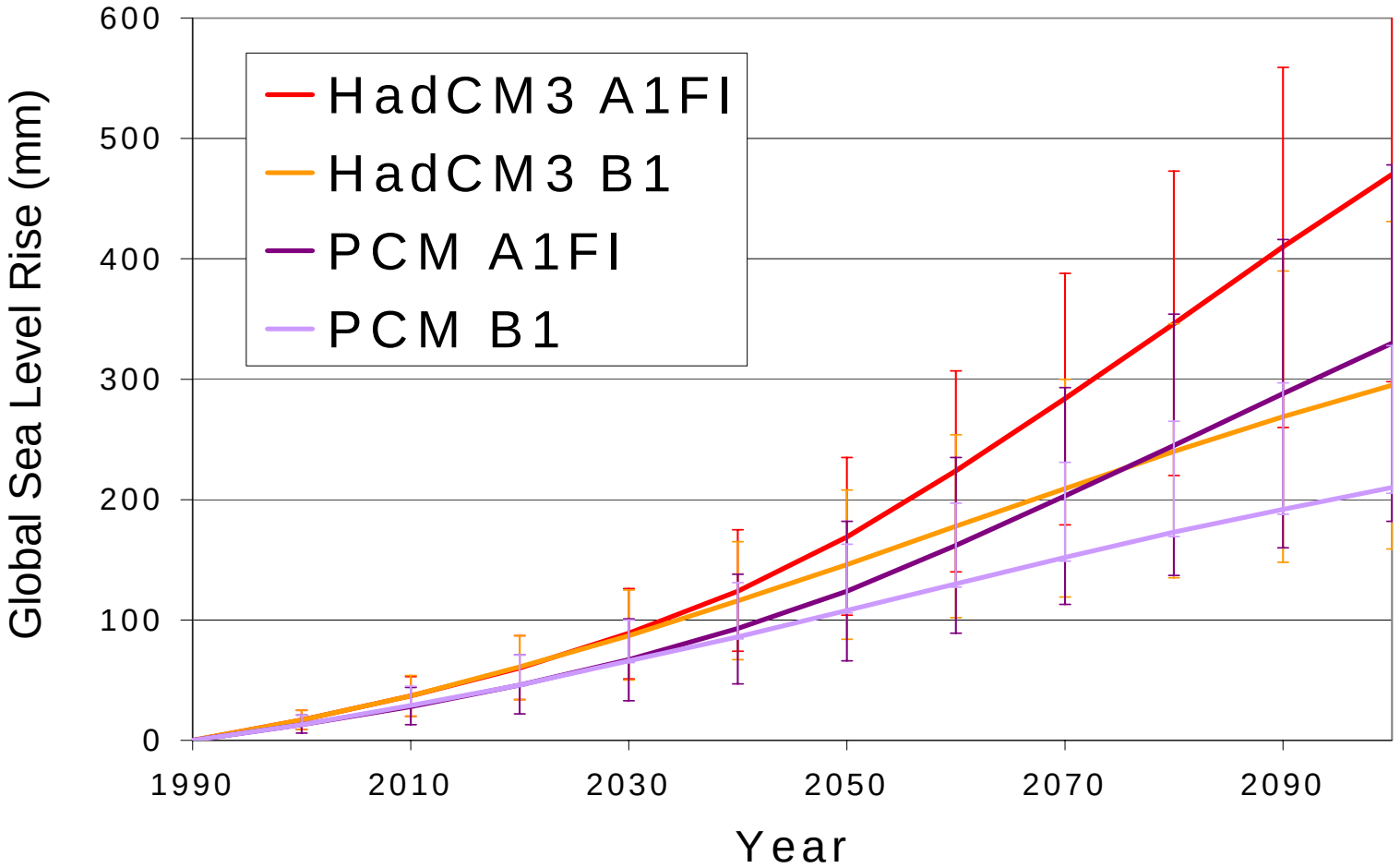
Projected (2099-2071) Divided by Historical (1961-1990)

	B1	A1fi
HadCM3		
PCM		

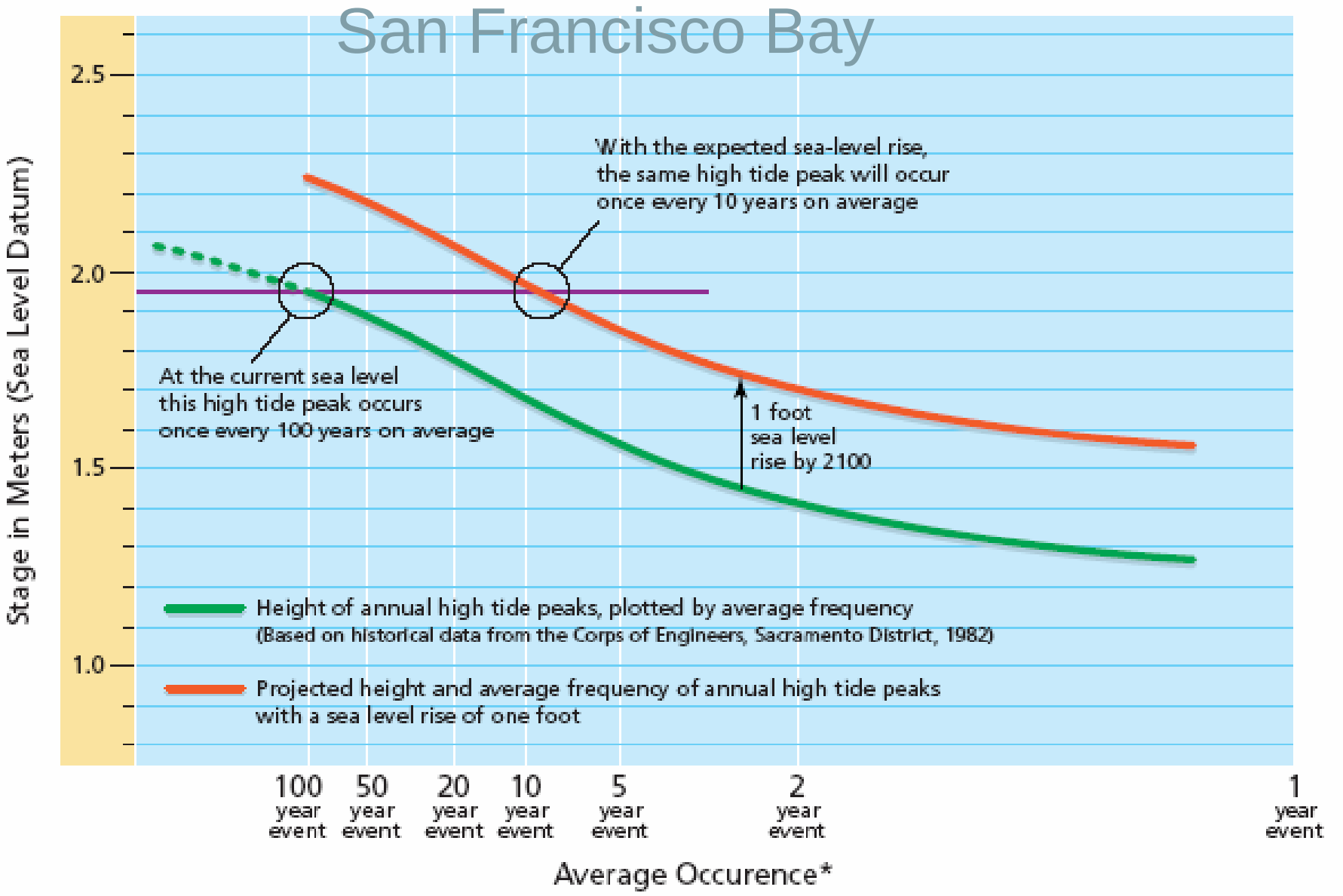
Mount Hood in Oregon at the same time in late summer in 1985 and 2002.

Sea Level Rise

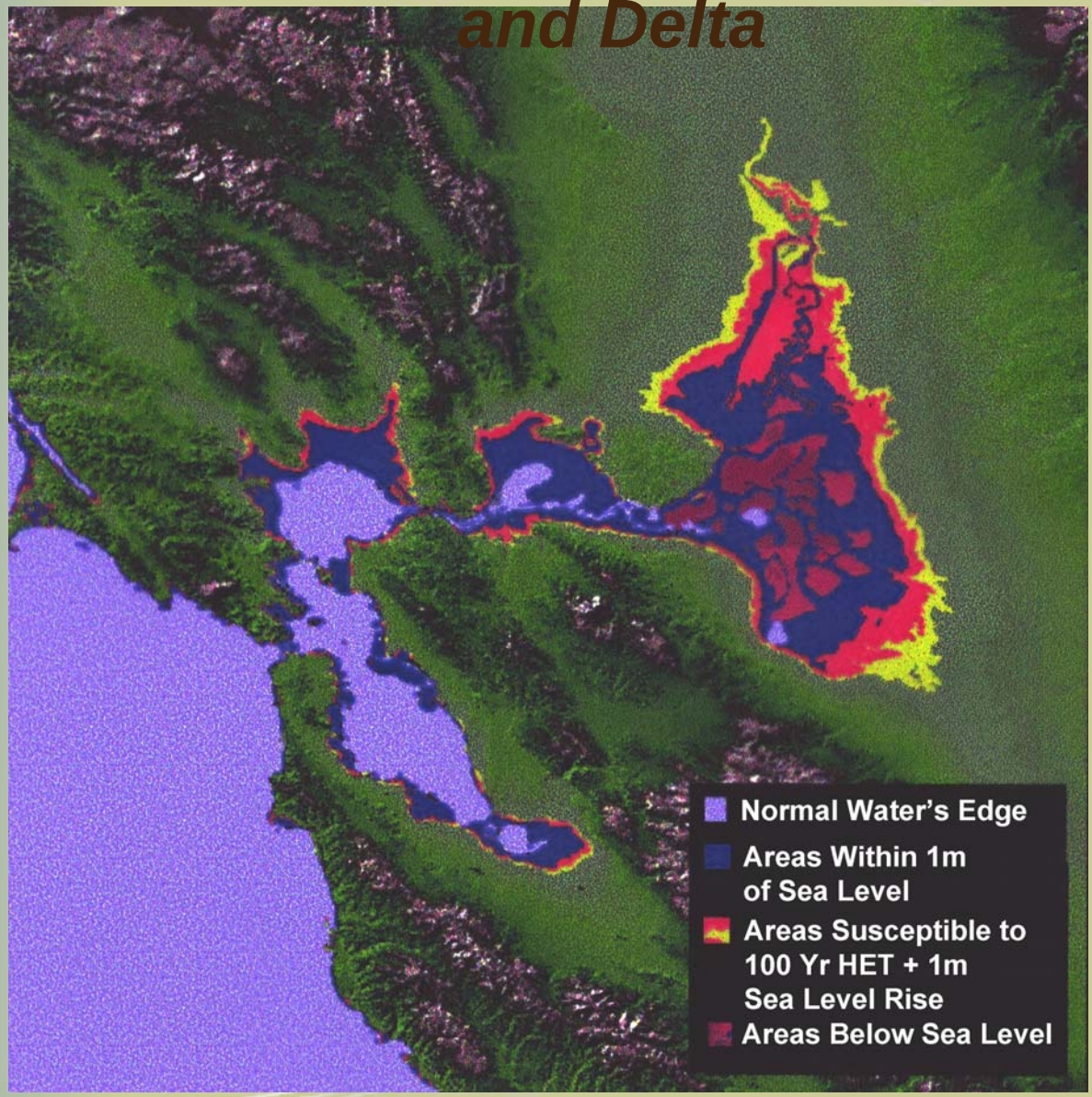
Thermal Expansion and Glacial Melt



A 30 cm rise shifts the 100 year tide to a 10 year ti



Sea Level Rise Impacts on the San Francisco Bay and Delta

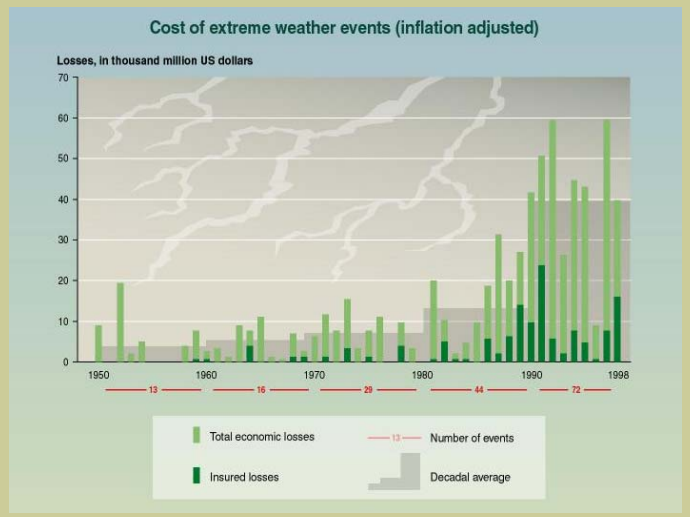


NATIONAL CENTER FOR HYDROLOGIC SYNTHESIS

Climate change: more mild and rainy winters in store for Finland

Global warming likely to increase extreme weather conditions

Helsinki and low-lying regions will likely be impacted by Sea Level Rise and Extreme Weather



Flooding is a fairly regular occurrence in the low-lying Ostrobothnia region.

Global warming could lead to more extreme fluctuations in weather conditions.

Conclusions

- Temperature increases more rapidly with higher emissions.
- Summer temperatures are higher than previously projected, accompanied by more heat waves and extreme temperatures
- Precipitation is more variable, tends towards slight decrease, and is not notably affected by emissions pathway.
- Substantial impacts occur under both emissions scenarios.
- More severe impacts result from the higher emissions pathway after the mid-century, but are entrained by higher emissions in preceding decades.
- Adaptation costs will increase with higher emissions; for some impacts, adaptation options are greatly limited.
- Higher emission pathway (A1fi; **“World Market”**) and the lower emissions pathway (B1; **“Global Sustainability”**) are not upper and lower limits.